98-G-304, Neutrinos at the Main Injector (NuMI), Fermi National Accelerator Laboratory, Batavia, Illinois

(Changes from FY 2003 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

None.

1. Construction Schedule History

	Fiscal Quarter				Total Estimated Cost ($000)	Total Project Cost ($000)
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
FY 1998 Budget Request *(A-E and technical design only)*	1Q '98	4Q '98	NA	NA	5,500	6,300
FY 1999 Budget Request (Preliminary Estimate)	--	3Q '99	1Q '99	4Q '02	75,800	135,300
FY 2000 Budget Request	3Q '98	2Q '00	3Q '99	2Q '03	76,200	136,100
FY 2001 Budget Request	3Q '98	2Q '00	3Q '99	2Q '04	76,200	138,600
FY 2001 Budget Request (Amended)	3Q '98	2Q '00	3Q '99	4Q '03	76,200	138,400
FY 2002 Budget Request	3Q '98	4Q '00	3Q '99	4Q '03	76,149	139,390
FY 2003 Budget Request	3Q '98	4Q '00	3Q '99	4Q '05	109,242	171,442
FY 2004 Budget Request	3Q '98	4Q '00	3Q '99	4Q '05	109,242	171,442

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
Design & Construction			
1998	5,500	5,500	1,140
1999	14,300	14,300	5,846
2000	22,000	22,000	15,089
2001	22,949	22,949	19,752
2002	11,400	11,400	21,489
2003	20,093	20,093	24,000
2004	12,500	12,500	14,000
2005	500	500	7,926

3. Project Description, Justification and Scope

The project provides for the design, engineering and construction of new experimental facilities at Fermi National Accelerator Laboratory in Batavia, Illinois and at the Soudan Underground Laboratory at Soudan, Minnesota. The project is called NuMI which stands for Neutrinos at the Main Injector. The purpose of the project is to provide facilities that will be used by particle physicists to study the properties of neutrinos, which are fundamental elementary particles. In the Standard Model of elementary particle physics there are three types of neutrinos that are postulated to be massless and to date, no direct experimental observation of neutrino mass has been made. However, there are compelling hints from experiments that study neutrinos produced in the sun and in the earth's atmosphere that indicate that if neutrinos were capable of changing their type it could provide a credible explanation for observed neutrino deficits in these experiments.

The primary element of the project is a high flux beam of neutrinos in the energy range of 1 to 40 GeV. The technical components required to produce such a beam will be located on the southwest side of the Fermilab site, tangent to the Main Injector accelerator at the MI-60 extraction region. The beam components will be installed in a new tunnel of approximately 1.5 km in length and 6.5 m diameter. The beam is aimed at two detectors (MINOS), which will be assembled in two new experimental halls located along the trajectory of the neutrino beam. One such detector will be located on the Fermilab site, while a second will be located in the Soudan Underground Laboratory. Two similar detectors in the same neutrino beam and separated by a large distance are an essential feature of the experimental plan. The FY 2004 funding is for construction and installation of the neutrino beam line in the underground tunnel.

The experiments that are being designed to use these facilities will be able to search for neutrino oscillations occurring in an accelerator produced neutrino beam and hence determine if neutrinos do have mass. Fermilab is the only operational high energy physics facility in the U.S. with sufficiently high energy to produce neutrinos which have enough energy to produce tau leptons. This gives Fermilab the unique opportunity to search for neutrino oscillations occurring between the muon and the tau neutrino. Additionally, the NuMI facility is designed to accommodate future enhancements to the physics program that could push the search for neutrino mass well beyond the initial goals established for this project.

4. Details of Cost Estimate[a]

(dollars in thousands)

	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design costs	7,150	7,150
Design Management costs (0.0% of TEC)	10	10
Project Management costs (0.0% of TEC)	20	20
Total, Engineering design inspection and administration of construction costs (6.6% of TEC)	7,180	7,180
Construction Phase		
Buildings	12,265	12,228
Special Equipment	20,902	20,902
Other Structures	40,184	41,265
Construction Management (8.6% of TEC)	9,379	6,846
Project Management (4.1% of TEC)	4,430	4,788
Total, Construction Costs	87,160	86,029
Contingencies		
Construction Phase (13.6% of TEC)	14,902	16,033
Total, Contingencies (13.6% of TEC)	14,902	16,033
Total, Line Item Cost (TEC)	109,242	109,242

5. Method of Performance

Design of the facilities will be by the operating contractor and subcontractor as appropriate. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bids.

[a] The annual escalation rates assumed for FY 1999 through FY 2005 are 2.4, 2.8, 2.7, 3.0, 3.1, 3.4, and 3.3 percent respectively.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2002	FY 2003	FY 2004	Outyears	Total
Project Cost						
Facility Cost						
Total, Line item TEC	41,827	21,489	24,000	14,000	7,926	109,242
Other Project Costs						
Capital equipment [a]	17,198	14,216	9,443	2,000	1,653	44,510
R&D necessary to complete construction [b]	1,768	0	0	0	0	1,768
Conceptual design cost [c]	1,928	0	0	0	0	1,928
Other project-related costs [d]	10,045	1,783	983	800	383	13,994
Total, Other Project Costs	30,939	15,999	10,426	2,800	2,036	62,200
Total Project Cost (TPC)	72,766	37,488	34,426	16,800	9,962	171,442

[a] Costs to fabricate the near detector at Fermilab and the far detector at Soudan. Includes systems and structures for both near detector and far detector, active detector elements, electronics, data acquisition, and passive detector material.

[b] This provides for project conceptual design activities, for design and development of new components, and for the fabrication and testing of prototypes. R&D on all elements of the project to optimize performance and minimize costs will continue through early stages of the project. Specifically included are development of active detectors and engineering design of the passive detector material. Both small and large scale prototypes will be fabricated and tested using R&D operating funds. Prior year totals have been adjusted to more accurately account for actual R&D costs.

[c] Includes operating costs for development of conceptual design and scope definition for the NuMI facility. Also includes costs for NEPA documentation, to develop an Environmental Assessment, including field tests and measurements at the proposed construction location. Prior year totals have been adjusted to more accurately account for actual conceptual design costs.

[d] Includes funding required to complete the construction and outfitting of the Soudan Laboratory for the new far detector by the University of Minnesota. In particular, includes $9,301,000 in prior years and $1,468,000 in FY 2002 for capital costs of cavern construction; remainder is operating expenses related to the construction of the cavern and the MINOS detector. Prior year totals have been adjusted to more accurately account for actual other project-related costs.

7. Related Annual Funding Requirements

(FY 2003 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs [a]	500	500
Utility costs (estimate based on FY 1997 rate structure) [b]	500	500
Total related annual funding	1,000	1,000
Total operating costs *(operating from FY 2005 through FY 2010)*	5,000	5,000

[a] Including personnel and M&S costs (exclusive of utility costs), for operation, maintenance, and repair of the NuMI facility.

[b] Including incremental power costs for delivering 120 GeV protons to the NuMI facility during Tevatron collider operations, and utility costs for operation of the NuMI facilities, which will begin beyond FY 2004.